

Glenn Research Center, Occupational Health Programs Manual

Chapter 6 - ELEMENTAL MERCURY

NOTE: The current version of this Chapter is maintained and approved by the Safety, Health, and Environmental Division (SHED). The last revision date of this chapter was March 2007. If you are referencing paper copies, please verify that it is the most current version before use. The current version is maintained on the Glenn Research Center (GRC) intranet at <http://smad-ext.grc.nasa.gov/emo/pub/ohpm/ohpm-manual.pdf>. Approved by: Occupational Health Branch Chief, Gayle Reid

PURPOSE

The purpose of this chapter is to eliminate or minimize employee exposure to mercury containing materials through a system of administrative and engineering controls and safe work practices. This chapter is intended to protect NASA property and the surrounding environment from mercury contamination and sets forth the policies and procedures to manage and clean-up uncontrolled releases of mercury.

APPLICABILITY

This chapter is applicable to all civil servant employees and operations at the GRC Lewis Field and Plum Brook Facilities. Contractors working at the Lewis Field and Plum Brook facilities are required to follow GRC's operational procedures in order to protect NASA property and equipment. Contractors are required to have their own policies on protecting employee health.

This document pertains to the elemental form of mercury: if you work with inorganic or organo-mercury compounds, please contact the OHB.

DEFINITIONS

Action Level - concentration or level of an agent at which it is deemed that some specific action should be taken. In general the action level is set at one half of the adopted occupational exposure limit.

Manometer - instrument used for measuring pressure; essentially a U-tube partially filled with a liquid (usually water, mercury, or a light oil), so constructed that the amount of displacement of the liquid indicates the pressure being exerted on the instrument.

Mercury Contaminated Surface - surface where mercury vapor level is at or greater than 0.005 mg/m³ when mechanically agitated.

Neurotoxin – substance harmful to the nervous system or brain.

Occupational Exposure Limit (OEL) – health-based workplace standard to protect workers from adverse exposure (e.g. PEL, TLV, REL etc.)

Permissible Exposure Limit (PEL) - OSHA's term that establish maximum allowable concentrations in air of substances in which nearly all workers may be repeatedly exposed 8 hours a day, 40 hours a week, for 30 years without adverse effects.

There are three different categories of PEL's:

- PEL-Ceiling (C) The limit that cannot be exceeded at anytime during the workshift
- PEL - Short Term Exposure Limit (STEL) A 15-minute time-weighted average (TWA) exposure that shall not be exceeded at any time during the workday unless another time limit is specified.
- PEL-8-hour Time Weighted Average (TWA) The maximum allowable concentration in air of a substance averaged over an 8-hour period.

Skin Notation - denotes the possibility that dermal absorption may be a significant contribution to the overall body burden.

Systemic Effect - adverse affect other than at the site of contact.

Target Organs - organs of the body most affected by exposure to a particular substance.

Threshold Limit Value (TLV) are exposure limits recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) under which it is believed that most people can work 8 hours a day, day after day, with no harmful effects. There are three different categories of TLV's:

- TLV-Ceiling (C) - a concentration that should not be exceeded during any part of the working exposure.
- TLV-Short-Term Exposure Limit (STEL) - a 15-minute TWA exposure which should not be exceeded at any time during a workday even if the 8-hour TWA is within the TLV-TWA. Exposures above the TLV-TWA up to the STEL should not be longer than 15 minutes, occur no more than 4 times per day, and there should be at least 60 minutes between successive exposures. An averaging period other than 15 minutes may be recommended when warranted.
- TLV-8-hour Time Weighted Average (TWA) - the maximum allowable concentration in air of a substance averaged over an 8-hour period.

Time Weighted Average (TWA) - average concentration for an 8-hour workday, 40 hour workweek.

Toxicity - inherent property of a chemical agent, its harmful effects on some biologic systems, and the conditions under which the effects occurs.

BACKGROUND

Elemental mercury, a silvery, odorless, heavy liquid, was used at GRC in thermometers, manometers, barometers, electrical equipment and as a propellant in ion propulsion systems. It is also found in mercoird electrical switches and mercury vapor and fluorescent lamps. Elemental mercury, which is also know as quicksilver, is not highly toxic as an acute poison, although inhalation of high concentrations of mercury vapor for relatively brief periods can cause severe problems with the lungs and digestive systems. Chronic exposure to mercury affects the nervous system causing tremors, irritability, anxiety, and manic depressive psychosis disturbances, loss of appetite, and weight loss.

The current American Conference of Governmental Industrial Hygienists (ACGIH) and GRC 8-hour time weighted average exposure limit for elemental mercury is 0.025 milligrams per cubic meter (mg/m^3). The Occupational Safety and Health Administration (OSHA) and GRC have also established a ceiling concentration limit of $0.1 \text{ mg}/\text{m}^3$, which may not be exceeded for any time period.

POLICY

It is the policy of GRC to comply with all applicable regulations regarding elemental mercury to prevent illness to workers, contamination of NASA property and damage to the environment from its use and disposal. To accomplish this, all personnel must comply with the requirements of this chapter.

Whenever possible, a substitute for mercury-containing devices, such as mercoird switches, thermometers, gauges etc. should be made. All unnecessary mercury sources including but not limited to mercury manometers, thermometers, and other mercury contaminated materials should be removed and properly disposed of from the GRC Lewis Field and Plum Brook Station by completing a C-260a Waste Disposal form and contacting Waste Management. Contaminated areas should be identified and cleaned up by personnel trained on the hazards of mercury and proper handling, clean-up and disposal procedures.

GRC policy defines mercury contaminated surfaces as those which yield mercury vapor level at or greater than $0.005 \text{ mg}/\text{m}^3$ when mechanically agitated.

It is GRC policy that mercury decontamination within areas controlled by research organizations must be funded by that research organization.

RESPONSIBILITIES

Occupational Health Branch (OHB) - Industrial Hygiene (IH)

- Provides guidance on the requirements of Federal, State, and local occupational health regulations.
- Provides support to Center personnel to identify mercury-contaminated areas.
- Provides industrial hygiene support in mercury use, spill cleanup and remediation projects.
- Measures employee exposure levels, recommends procedures and personal protective equipment to minimize exposures, and recommends employees for inclusion in a mercury medical surveillance program.
- Recommends employees for inclusion in a medical monitoring program
- Provides Mercury Awareness Training

Occupational Health Branch - Technical Services

- Conduct mercury surveys
- Provides sampling and analysis support to identify mercury contamination of vacuum pumps and other equipment.
- Maintains a calibration station for the Jerome mercury air monitoring equipment and calibrates equipment as needed.

Occupational Health Branch – Medical Services

- Manages and administers the medical surveillance program for civil servant employees exposed to mercury.

Environmental Management Branch (EMB)

- Provides guidance on the requirements of the applicable Federal, State, and local environmental regulations.
- Provides guidance and oversight on the disposal of mercury through the Waste Management.
- Assesses and makes recommendations on air, water, or soil pollution issues.
- Oversees spill cleanup and soil and water remediation projects.
- Provides some types of analysis of mercury contamination in various mediums.
- Waste Management:
 - Provides guidance and oversight on the disposal of mercury containing materials and wastes.
 - Ensures that mercury contaminated material is properly packaged and stored prior to disposal.
 - Coordinates mercury spill cleanups and decontamination by contractors.
 - Provides guidance on the requirements of Federal, State, local, GRC transportation and environmental disposal requirements.
 - Performs decontamination for small spills.Maintains records of mercury disposal.

Environmental Management Branch - Chemical Management (CM)

- Maintains the inventory for mercury and mercury containing compounds.
- Reviews chemical purchases and notifies OHB
- Notifies OHB when an SOP is submitted with mercury containing material in use
- Conducts Hazard Communication Training

Facilities Division (FD), Project Managers, Facilities Engineers, and Facilities Operations Personnel as part of their role in construction, demolition and rehab projects:

Ensure that areas contaminated or potentially contaminated with mercury are managed to minimize employee exposure to mercury.

Ensure that renovation projects plans identify mercury-contaminated areas and provide for cleanup.

- Identifies areas with suspected mercury contamination not listed in the original scope of work that surface during construction activities.
- Arranges for testing to determine the level of mercury contamination.
- Ensures cleanup of any contamination by a qualified contractor.
- Ensures that mercury-related work is performed in accordance with all applicable regulations and EMB guidance.

Logistics Management Division (LTID)
Procures alternative mercury containing devices

Supervisors

- Notify OHB of operations involving exposure to mercury.
- Enforce requirements requiring the use of engineering and work practice controls and personal protective equipment.

Employees

- Report quantities of mercury stored in vials, bottles, or equipment to Chemical Management.
- Notify OHB of operations involving mercury.
- Properly use engineering controls, work practice controls, and personal protective equipment specified for their operations.
- Properly dispose of all mercury containing devices (i.e., thermometers, mercuric switches, etc.) through Waste Management.

PROCEDURES

Use of Current Materials

OHB must be kept apprised of mercury use throughout the lab.

Hazard Assessment

A hazard assessment is required by an industrial hygienist when:

- Mercury is being requested for purchase.
- A process which uses mercury changes.
- A new task not previously assessed that uses mercury is planned .
- Equipment known or suspected of containing mercury is planned to be used .
- Areas known or suspected of being contaminated by mercury .
- Individuals currently using mercury must schedule for a hazard assessment to be performed during the next scheduled use of mercury. The user or area supervisor must contact OHB prior to use and arrange for an industrial hygienist to observe the handling of the material, assess the hazards and perform exposure monitoring if necessary.

Results from the hazard assessment will be reported in writing with findings and recommendations. In addition, any equipment suspected of containing mercury will be tagged with the results of the survey.

Assessment of Vacuum Pumps

Prior to dismantling, repairing, removing or altering vacuum pumps they must be tested for mercury contamination. A work order must be submitted to Chemical Sampling and Analysis for testing the pump oil to determine if the pump is mercury contaminated. Chemical Sampling and Analysis will submit the results to OHB.

Disposal of Mercury-Contaminated Equipment

Chemical analysis results for pumps that are being disposed of will be forwarded onto Environmental Compliance. Environmental Compliance will prepare a written report with recommendations and send it to the requester and Waste Management. The requester will then attach a copy of the report to the pump.

All mercury-containing equipment that is to be disposed of must be drained and the mercury reclaimed. To dispose of mercury-containing or -contaminated equipment, submit a NASA C-260A Form to property disposal. Waste Management maintains the records for disposal of mercury and mercury contaminated wastes.

Mercury Spill Response Procedures

It is imperative that employees do not attempt to clean-up a mercury spill by themselves. This can inadvertently spread the contamination. Regular vacuum cleaners, mops and brooms must never be used to clean up a mercury spill. Heat from the vacuums motor will increase the amount of mercury vapor in the air. Mops and brooms will spread the mercury, making proper cleanup more difficult and costly. The vacuum cleaner, mop or broom will become

contaminated and require disposal as a hazardous waste. Mercury cannot be disposed of down the drain or in the trash.

1. Call 9-1-1 from a NASA phone or from a cell phone call 216-433-8888 to report a spill.
 - . state your name
 - . phone number where you can be contacted
 - . the department, building, and room number where the mercury is located
2. Evacuate the area and prevent traffic from going through the spill area. Before people leave, be sure they have not come into contact with mercury. Those who may have come into contact with mercury should be directed to a nearby location away from the spill and asked to stay there until contamination can be assessed.
3. Once emergency dispatch is called, first responders will be dispatched to secure the area and implement the Emergency Preparedness Plan.
4. Anyone entering into the spill area will be provided with tyvek booties to protect the contamination of shoes and reduce the spread of mercury.

Reducing the Risk

The most effective method of reducing personal exposure to mercury and avoiding a costly spill clean-up is to properly dispose of all mercury containing devices and replace with less toxic alternatives.

For assistance with replacing mercury-containing equipment and devices with mercury-free alternatives contact Rich Miller at 433-3780.

- To dispose of mercury-containing equipment, simply complete a C-260a form and Waste Management personnel will remove and dispose of the equipment for you at no cost.

If you must work with mercury as part of your research, consult with OHB-Industrial Hygiene to develop work practices that minimize the risk of exposure.

RECORDS

OHB maintains:

- Hazard Assessments
- Survey Monitoring Data Sheets.
- Hazard/Exposure Assessment Database
- Locations of Mercury Contaminated Areas
- Mercury Vapor Analyzer calibration documents.

REFERENCES

U.S. Department of Labor, Occupational Safety, and Health Administration (OSHA), 29 CFR 1910.1000, Air Contaminants.

Memo dated November 8, 1989, from Director of Technical Services and Chairman of the Environmental Pollution Control Board regarding "Use of Mercury Manometers for Pressure Measurement."

Memo dated June 2, 1993, from Director of Technical Services and Chairman of the Environmental Pollution Control Board, regarding "Use of Mercury Manometers for Pressure Measurement."

Memo dated August 12, 1991, from GRC Mercury Coordinator regarding "Recall of All Mercury"

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